

Anomalous Proximity Effect in Superconductor/Normal/Ferromagnetic Trilayer Systems: Signature of Triplet Superconductivity ?

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We have expanded the experimental study of proximity effect of superconductor/ferromagnetic or superconductor/normal bilayer systems into superconductor/normal/ferromagnetic trilayer systems by using Nb as the superconductor(S), Au or Al as the normal metal(N) and CoFe or NiFe as the ferromagnet(F). The superconducting critical temperatures have been measured as a function of each thickness of S, N and F. One very unexpected result is that the critical temperature of the trilayer system was found to increase very rapidly when the thickness of N increases from 0 nm to a few nm while the T_c 's of SNF trilayers were found to be lower than those of SN bilayers even when the thickness of N was over a few hundreds of nm. Another unexpected result is that the T_c 's of the trilayers were found to have oscillatory behavior as a function of N in the length scale of tens of nm, difficult to understand in the framework of conventional theory. We will try to explain in a phenomenological way how these unexpected behavior can happen and what implication it might have in the proximity effect of SNF trilayers, namely a triplet superconductivity.

keywords : proximity effect, ferromagnet, triplet superconductivity